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## PRE-APPEAL BRIEF REQUEST FOR REVIEW

Docket Number (Optional)

052189

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Application Number

10/525,753

Filed

September 16, 2005

First Named Inventor

Shigeki OTANI

Art Unit

2826

Examiner

Fazli Erdem

Applicant requests review of the final rejection in the above-identified application. No amendments are being filed with this request.

This request is being filed with a notice of appeal.

The review is requested for the reason(s) stated on the attached sheet(s).

Note: No more than five (5) pages may be provided.

I am the

☐

applicant/inventor.

☐

assignee of record of the entire interest.

See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed.  
(Form PTO/SB/96)

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attorney or agent acting under 37 CFR 1.34.

Registration number if acting under 37 CFR 1.34 \_\_\_\_\_

  
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November 27, 2006

Date

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below\*.

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\*Total of 1 forms are submitted.

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re the Application of: **Shigeki OTANI et al.**

Group Art Unit: **2826**

Application Number: **10/525,753**

Examiner: **Fazli Erdem**

Filed: **September 16, 2005**

Confirmation Number: **2033**

For: **DIBORIDE SINGLE CRYSTAL SUBSTRATE AND  
SEMICONDUCTOR DEVICES USING THE SAME AS WELL AS  
METHOD OF MAKING SUCH DEVICES**

Attorney Docket Number: **052189**

Customer Number: **38834**

**PRE-APPEAL BRIEF REQUEST FOR REVIEW**

Mail Stop: AF

Commissioner for Patents

P. O. Box 1450

Alexandria, VA 22313-1450

Date: **November 27, 2006**

Sir:

This Request is filed concurrent with a Notice of Appeal in compliance with 37 C.F.R. §41.31. Applicant requests review of the final rejection in the above-identified application. No amendments are being filed with this request.

**REMARKS**

Claims 1, 3 and 5-24 are pending in the present application.

Claims 1, 20, 21 and 23 stand rejected under 35 U.S.C. 102(b) as being anticipated by **Otani et al.** (EP 1176231).

Applicants respectfully submit that the rejection is clearly in error as there is no teaching of the limitations of claims 1, 20 and 23 which require that the diboride single crystal substrate

has an orientation flat exhibiting a (10-10) or (11-20) plane and has a thickness of 0.1 mm or less.

As is well established under the law of 35 U.S.C. §102, a claim is anticipated by a reference only if each and every limitation is taught in substantially the same manner by the reference. In the current case, **Otani** does not teach the orientation flat exhibiting a (10-10) or (11-20) plane and also does not teach a substrate thickness of 0.1 mm or less.

(1) **Orientation Limitation**

In regard to the orientation flat exhibiting a 10-10 or 11-20 plane, the Examiner points to the disclosure in **Otani** at paragraph [0029]. This paragraph discloses a (11-20) crystal plane orientation, but is referring to the optimal planes “to grow the semi-conducting nitride layer.” Hence, **Otani** is teaching that the (11-20) crystal plane is an alternative facial orientation to the (0001) orientation.

Contrary, the present invention is facially oriented in a (0001) plane with a perpendicular side surface exhibiting a (10-10) or (11-20) plane. As illustrated in Figs. 1(a) and 1(b) and disclosed in paragraphs [0031] to [0034] of the present application, the  $\text{XB}_2$  single crystal substrate is constituted by a principal surface having a (0001) crystallographic plane 2 with a cut side surface in (10-10) plane 4. See also Fig. 4 and paragraph [0046].

**Otani** does not teach this limitation. Further this limitation would not be inherent to the substrate of **Otani** because there is no teaching that the diboride single crystal has a thickness of 0.1 mm or less.

(2) **Substrate Thickness Limitation**

The Examiner further maintains that **Otani** discloses the required thickness of the present invention at paragraph [0008]. However, this paragraph is discussing prior art characteristics of a sapphire substrate. Specifically, the lattice constant of sapphire is excessively larger than that of GaN and AlN and a buffer layer is therefore required. There is no identifiable teaching that a diboride single crystal is formed with a thickness of 0.1 mm or less. Paragraph [0046] of **Otani** describes ZrB<sub>2</sub> and TiB<sub>2</sub> crystals being formed to have a length of 9 to 16 mm along a direction perpendicular to axis <0001>.

Contrary, the present inventors have discovered that making a XB<sub>2</sub> single crystal substrate 0.1 mm or less in thickness permits the XB<sub>2</sub> substrate to be divided along a (10-10) plane of a nitride compound semiconductor to allow for ease in formation and due linearity. Reducing the thickness to 0.1 mm or less allows the diboride single crystal to be cut with its cut surface made parallel to (10-10) plane 4. This provides a favorable cut surface in terms of reducing the difficulty in cutting and provides the (10-10) plane rather than a (10-11) plane. Hence the (10-10) plane 4 of the XB<sub>2</sub> substrate is congruent with (10-10) in which a cleavage surface of a nitride compound semiconductor lies. See paragraphs [0033] to [0039] and [0044].

There is no teaching in **Otani** of reducing the thickness of the XB<sub>2</sub> substrate to 0.1 mm or less. Hence, this limitation of claims 1 and 23 is not anticipated.

Pre-Appeal Brief  
Serial No. 10/525,753  
Attorney Docket No.052189

In view of the above remarks, Applicants submit that the rejection is improper. Accordingly, it is respectfully requested that the rejection of the claims be withdrawn and the application be passed on to allowance.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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